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# Advances in sub national measurement of the Human Development Index: The case of Mexico

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# Abstract

This paper surveys the main informational, conceptual and theoretical adjustments made to the HDI in the Mexican Human Development Reports and presents a way in which the calculation of the HDI could be carried out to the individual level. First, informational changes include redistributing government oil revenues from oil producing regions to the rest of the country in order to obtain a better picture of available resources and imputing per capita average household income to all municipalities combining census and income surveys. Also, state information is used to set counterfactuals about the first effects of internal migration on development, and municipal data is applied to decompose inequality indices to identify the sources and regions contributing to overall human development inequality. Second, conceptual adjustments consider introducing two additional dimensions to the HDI: being free from local crime and the absence of violence against women. Third, a key theoretical contribution from the Mexican National Reports to the HDI literature is the proposal of an inequality sensitive development index based on the concept of generalized means. Finally, the proposed disaggregation of the HDI at the household and individual level allows analyzing development levels for subgroups of population either by age, ethnic condition, sex and income or HDI deciles across time.

**Keywords:** Human Development Index, individual HDI, household HDI, inequality, migration, local crime, absence of violence against women, generalized means.

**JEL classification:** C81, I3, D63, O15

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## **1. Introduction**

In 1992 Bangladesh, Cameroon, Pakistan and the Philippines published their first National Human Development Reports (UNDP, 1998). Mexico did not get its first report until 2003. However, in 1993, the Third Global Development Report included an analysis of the Human Development Index (HDI) at the sub national level for Mexico. More important between 1997 and 2000, several academic and government studies presented new information and disaggregated HDI's for the 32 Mexican states and the more than two thousand municipalities; these studies overcame the data limitations, thus advancing with several methodological issues on sub national measurement (PNUD, 2003).

Perhaps the key contributions of the Mexican experience to the HDI calculation are contained in the national reports and related publications, like the use of generalized means to get an inequality sensitive HDI and the application of imputation techniques to obtain the index where no GDP data is available. For example, the 2010 National Report includes a conceptual development of the HDI and a method for its calculation from income-expenditure surveys that allows obtaining the index at the household and individual level, thus being able to report it by gender, age, ethnicity or almost any other grouping.

The Mexican case goes beyond reformulating the HDI or obtaining hard to get data for its estimation. It has been used to assess the allocation of public expenditure at state level, the effect of crime incidence and violence towards women, and to calculate the redistributive consequences of internal migration, among other exercises. For the 2010 National Report,

the HDI at the household and individual levels will be used to assess the vertical and horizontal equity of human development expenditure (see table A).

This paper has two purposes: 1) surveying the main adjustments made to the HDI in the Mexican National Human Development Reports, either informational, conceptual or in measurement theory, and their innovative uses, and 2) presenting a detailed way in which the calculation of the HDI at the sub national level could be carried out to its extreme, that is to the individual level. The first part is brief and general, whilst the second one presents some of the technical requirements for the disaggregation and application of the HDI in other countries. A final section summarizes the adjustments and uses of the HDI for the Mexican case and comments on the relative importance of each of them.

**Table A. Key contributions of the Mexican experience to HDI calculation, timeline.**

<b>Year</b>	<b>Contribution</b>	<b>Source</b>
2003	Mexico's first Human Development Report	PNUD, 2003
2003	HDI sensitive to inequality	PNUD, 2003
2003	Reallocation of oil component of state's GDP	PNUD, 2003
2004	Simulation of public security dimension into HDI	PNUD, 2005
2007	Simulation of absence of violence against women dimension into HDI	PNUD, 2007a
2007	Migration Effects on HDI	PNUD, 2007b
2008	Computation of municipal HDI	PNUD, 2008a
2008	HDI inequality decomposition by component	PNUD, 2008a
2010	HDI at household and individual level	PNUD, 2010 (forcoming)

## **2. Information, conceptual and measurement adjustments to the HDI**

Human development reflects people's freedom; it is the set of possibilities that individuals can choose from. Three of the main human capabilities are the possibility of a long and healthy life, being able to acquire valuable knowledge, and the opportunity to obtain the resources for a respectable standard of living. Any type of human development measurement is a simplified representation of the original concept, comprising only a selection of its elements. The initial HDI was designed for nations and has chosen three basic dimensions for its measurement: longevity, knowledge and access to resources. As its indicators, the index proposes life expectancy at birth, literacy and school enrollment rates, and per capita Gross Domestic Product (GDP). The indices for each of these dimensions are aggregated with equal weights in a simple average.

Basic sub national analysis of the HDI in Mexico starts at the regional level (regions defined by the National Development Plan of the Federal Government), but since regions are composed of groups of the 31 states and the Federal District (here considered as equivalent to a state), it is fair to say that the initial measurement is at the state level. The next level of disaggregation comprises state municipalities (2,440 in 2010) and political delegations in the Federal District (16 of them, here considered as equivalent to municipalities).

Adjustments to the informational basis of the HDI have been carried out in Mexico at the state and municipal level. In this section it is described how state GDP has been adjusted to account for extraordinary oil revenues and how income data is generated for municipalities

with imputation techniques due to the absence of GDP information at this level. In both cases, the use of state and municipal HDI is illustrated, first with the distribution effects of internal migration and then with the decomposition of national inequality by sources of the HDI.

The conceptual changes to the HDI, the second kind of changes, include adding new dimensions to the index's basic formula, while avoiding the temptation to consider the HDI as the beginning of a grand task to comprehend all measures of human development. This document presents an exercise in which an index of local crime, within the institutional responsibilities of state authorities, is incorporated as a dimension of public security in order to illustrate how the introduction of a new dimension changes the existing rankings of the HDI.

Finally, it has been recognized that even after accepting the existing dimensions and data of the HDI, a basic aspect of human development is missing: the inequality between persons or groups and its achievements. This section summarizes the proposal advanced in the First National Report, which introduces an inequality sensitive HDI grounded in an axiomatic approach and illustrates the use of such index in guiding public expenditure allocation among the states.

## **2.1 State measurement of the HDI and the effects of migration**

Few major changes to the official UNDP methodology have been introduced at the state level, except for the inclusion of new dimensions of the HDI that are described in section

2.2, but one of them is worth to mention here: the adjustment of state GDP to account for extraordinary oil revenues.

In order to get historical data on the HDI's evolution in México, the oil component of the states GDP has been reallocated among them. Oil revenues increased heavily in Mexico in the 1970's, but because the oil industry is in the hands of the Federal Government, most of this income accrued the public purse, which in turn redistributed it to the states according to budget allocation formulas. In other words, unadjusted GDP overestimated available resources to oil rich states, but underestimated those of the rest.

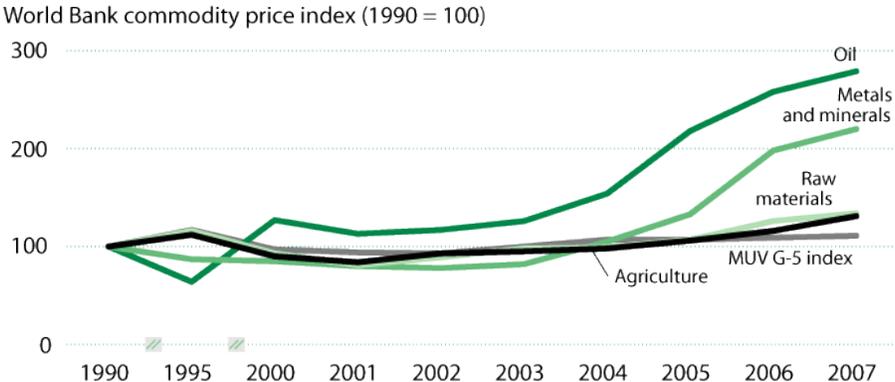
The adjustment consists on deducting the amount of oil revenues that passed from oil producing states to the Federal Government, and then to adding the amount of these resources allocated to all the states, closely replicating the redistribution formulas of the public sector (Esquivel, et. al. 2003). This adjustment meant that the two oil rich states (Campeche and Tabasco) fell eight and one position in the HDI ranking, while almost all of the rest changed places (PNUD,2003).

This kind of adjustment could be relevant not only for state owned economic activities, like copper mining in Chile, but also for heavily taxed activities in which the central governments execute some kind of redistribution policies, like gas extraction in the Russian Federation. This is worth, considering the rising importance of trade and the increasing demand for primary commodities. World Bank (2008) argues that globalization and the rapid industrialization have increased the prices of oil, metals, and minerals rapidly since

2002. As a result, many primary commodity–exporting economies have experienced strong GDP growth, while oil- and metal-importing economies have seen price increases (graph 1). In any case, this points to correcting gross miscalculations of available resources to a geographic region in order to be close to the spirit of the HDI, which calls for estimating the material opportunities for a decent standard of living.<sup>i</sup>

**Graph 1**

**Oil, metal, and mineral prices**

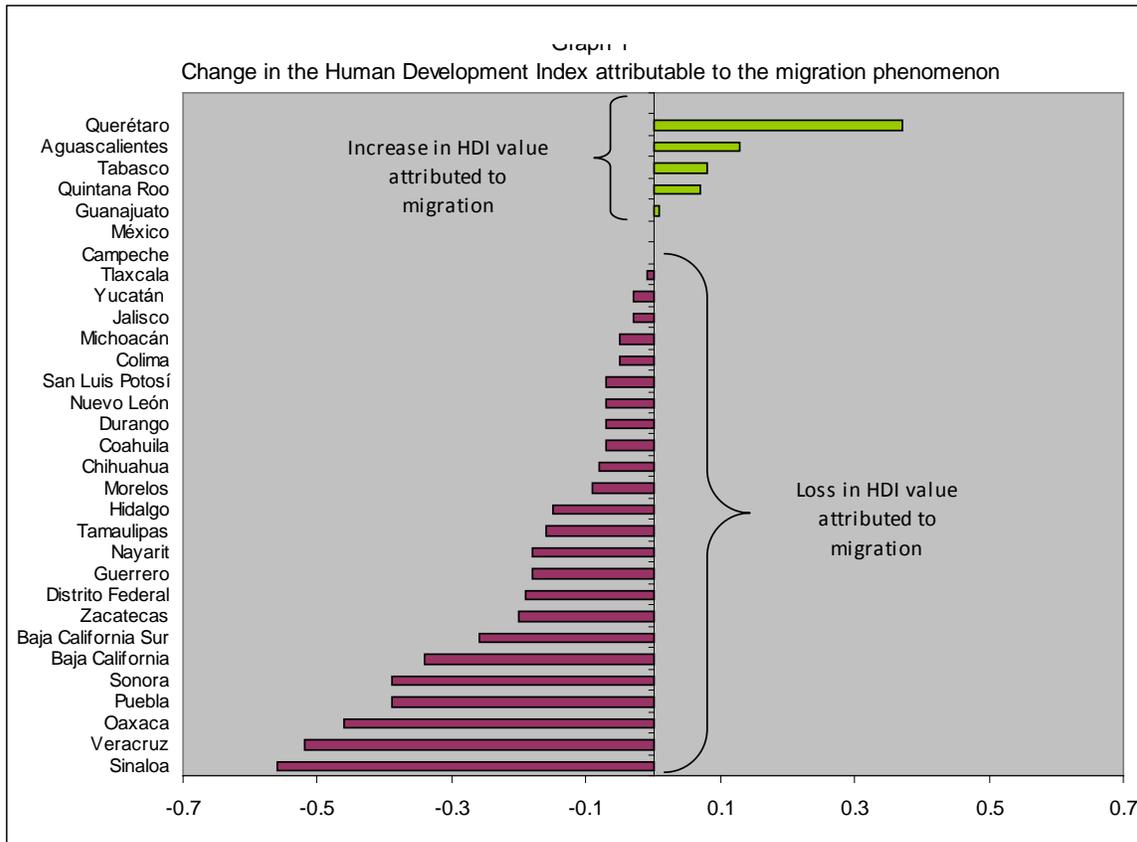


As for new uses of state HDI data, the case of domestic migration is an interesting one. When migration occurs from one state to other, the HDI of origin and destination states are expected to change due to different forces put in motion. First, the traveling of human beings from one place to another modifies the geographic distribution of personal characteristics that move with the migrant population. Second, new market conditions occur due to shifts in supply and demand of labor and goods associated with migrants. Of course, more complex social changes are associated with migration, but the initial redistribution of human development remains of interest.

Following Soloaga and Lara (2006), first effects of migration on the HDI are calculated creating “virtual states” by subtracting from each one the immigrants from other states and adding those that originally resided in the state, but went to live to other states. Those virtual states are the migration-less comparison groups. What is really subtracted or added to each data base in this accounting exercise are the HDI’s of the individuals involved in the migration process under the following assumptions: a) All individuals maintain their ability to read and write and its willingness to attend school as detected in the information that identified their migration status. b) If a person is “returned” to a virtual state, his/her income is imputed using a Mincerian regression that accounts for his/her personal characteristics (age, gender, schooling, etc.) and origin and destination states. c) No adjustment is made to life expectancy at birth due to information constraints to calculate “before” and “after” migration effects on health.

After performing this exercise, it is found that the impact of migration is negative for most of the states of the country i. e. the absence of migration would imply a greater HDI for 25 states (Graph 2).

**Graph 2**



This does not mean that the existence of migration is harmful for the migrants or the country as a whole, but that the redistribution of HDI's appears to be this way. In fact, if a migrant with higher than average education index in the virtual state A departs to virtual state B, *ceteris paribus*, where he/she has a lower than average index, both states "loose", in the sense that their average HDI decreases, even if the average HDI of all states remains the same. This information is a reminder that even if human mobility is neutral or beneficial for everyone, the statistics may convey another message.

The next natural step in this line of analysis would be the construction of a general equilibrium model to compute all the effects of internal migration, not just its first redistributive consequences. But before embarking in the use of this not so simple tool, and the myriad of assumptions to make it work, it is good to know that there is a limited but pertinent way to connect migration movements with the HDI changes.

## **2.2 Municipal measurement and inequality analysis**

In Mexico, as in many other countries, there is available national and state like information that is in accordance with the methodological requirements to calculate the HDI. However, this is different for the next level of disaggregation: municipalities.

Even if very good proxies were found for municipal life expectancy (like infant mortality) or school enrollment (school attendance is used in the Mexican case), no municipal GDP or income is part of any reliable database. In order to fine-tune diagnostics and provide regional policy recommendations, the only available source of information at this level was used: census data.

Census income data is particularly unreliable to get an index of available resources for a decent life. On the other hand, income surveys like the Encuesta Nacional de Ingresos y Gastos de los Hogares (ENIGH) are rich in information on income, but only allow estimations of very aggregate geographical indices. However, both data were obtained for the same years (2000 and 2005) and have key socioeconomic variables in common, like years of schooling, occupation, age and gender, among others.

Following Elbers, Lanjouw and Lanjouw (2002), an estimation of per capita average household income was obtained for all municipalities combining census and income surveys following these stages (Lopez-Calva et. al. 2005):

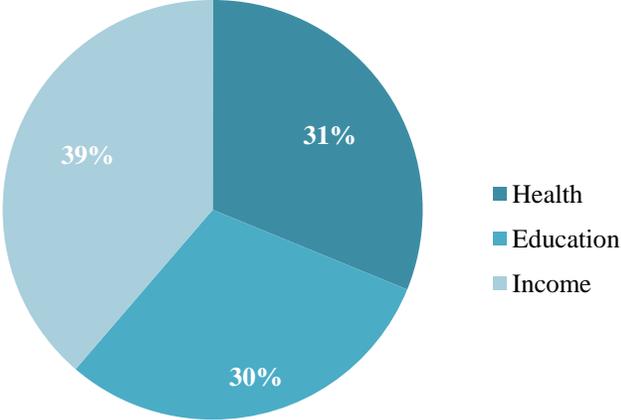
- 1) Use the national income survey to model per capita household income at the most disaggregated geographical level using several specifications for different regions.
- 2) Combine the first-stage parameters that had been estimated in the modeling exercise with the observable characteristics of each household in the census to generate incomes.
- 3) Develop HDI maps including other relevant indicators.

Upon examination of human development distribution at this level, a new view of great inequality emerged, illustrated by the fact that if municipalities were classified as countries, one of the political districts in Mexico City would have a development level similar to Italy, whereas the less developed municipality would have a HDI similar to that of Malawi (PNUD, 2007b).

When municipal data is obtained this way, it's possible to perform a more complete analysis of the sources and main geographical regions contributing to overall HDI inequality. Since the HDI can be seen the sum of three components (health, education and income indices), it is possible to apply inequality decomposition techniques that are able to identify which source of the HDI has more importance on overall inequality and by how much. One of such decomposition exercises can be performed using the coefficient of variation, which allows obtaining the percentage of inequality attributed to each HDI

dimension (PNUD, 2008a). In 2005, most of the national inequality of HDI at the municipal level came from the income index, whereas 32.9% and 30.1% of inequality was explained by the education and health components (see Graph 3).

**Graph 3 HDI inequality by component (%)**



Source: UNDP, 2008

Decomposition can also be performed to identify inequality between and within groups using municipalities as basic units and the states to which they belong as groups. In this way, most of the inequality of national HDI is associated to the differences within the federal entities (64.12%), while the differences between entities are not as large (35.8%). Additionally, when analyzing the previous situation, the national inequality of HDI is found to be originated mainly in the states of Veracruz (8.9%), Oaxaca (7.1%), Chiapas (6.9%), Puebla (6.3%), Guerrero (6.1%) and the State of Mexico (5.0%). This provides a way to target specific regions if national inequality had to be significantly reduced.

In general, the availability of municipal indices using imputation techniques provided a new perspective and tools for regional diagnostics and policies that eventually translated in public action. In 2005, after the first set of data was calculated, the Federal Government allocated special resources to the indigenous municipalities with the lowest HDI. In 2007, this policy extended to the one hundred municipalities with the lowest HDI in general, and in the poorest state, Chiapas, the 2010 program against poverty in 28 municipalities was guided using the HDI.

Sub national estimation of HDI might be applied in countries where similar exercises have been performed. Some studies in different countries have already embarked on this technique in order to obtain representative welfare measures for small geographical units, sub-regions or specific localities. Countries like Ecuador, South Africa, Brazil, Panama, Madagascar, Nicaragua and Mozambique have performed this kind of computations to allow poverty estimations [see Alderman et al. (2002), Elbers et al. (2001) and Elbers et al. (2002)]. Other survey country experiences with the same methods are Albania, Bolivia, Indonesia, Morocco, Thailand and Vietnam [see Bedi, Coudouel, Simler (2007)]. As mentioned before, this imputation is a very important input that may allow constructing sub-regional HDI estimations.

### **2.3 New dimensions: public security and violence towards women**

The HDI is a useful measurement device and a political tool that influences public policies. Nevertheless, it is far from being an all encompassing welfare measure, since it only takes certain human development issues but not others, which are also essential for the quality of

life. Thus, rankings based on those certain indicators may result in misleading judgment elements of individual welfare from an integral human development perspective.

To search for a “complete” measure of human development by adding dimensions and their variables in order to obtain the true complexity of this concept is a dead end. This pursue of the Holy Grail of human development indicators will always be incomplete and prone to obscure rather than enlighten the basic concept. However, it is fair to ask what would happen if the simple HDI is complemented by a novel aspect of human freedom. This exercise is more a sensitivity analysis than anything else.

Thus, for instance, the 2004 National Report considered the quality of institutions as crucial to effectively attain human development, particularly of those institutions related to public security, since protection of the most valued possessions of individuals, their personal integrity, their patrimony and their civil rights are fundamental elements for the exercise of individual freedom. That protection facilitates individuals to choose among alternative ways of living according to their own objectives and provides them with a higher potential to develop a full life. A weak protection of the individuals’ rights and freedom represent then a serious obstacle for human development.

The above elements were translated in terms of the HDI by introducing a new public security dimension as:

$$1) \quad \text{Dimension index} = \frac{X - X_{\min}}{X_{\max} - X_{\min}}$$

Where  $X = 1 - C$ , and  $C$  was the number of local crimes reported as percentage of state population. Maximum and minimum values were obtained from the state database provided by Zepeda (2004). This dimension was added to the HDI with the same weight as the health, knowledge and resources dimensions.

When carrying out this exercise, Baja California lost more than 20 places with respect to its original national HDI position and the Federal District lost nine places (see Table 1). Although this is a very simple exercise, it clearly shows how the HDI could provide new partial information on the status of freedom of individuals in a wider sense.

A very similar exercise was carried out in PNUD (2007a) and PNUD (2009), but this time introducing the absence of violence against women as a dimension of freedom. Clearly, the presence of physical, psychological and emotional violence from men against women undermines basic aspects of agency and equality of opportunity that are at the core of the human development perspective, so it was only natural to ask how would the HDI change if an index of absence of violence towards women was introduced.

In this case, variable  $X$  is the percentage of women with a male partner that do not report any kind of domestic violence incidence;  $X_{\max}$  equals one (the maximum percentage of women that could be subject to violence in a given state) and  $X_{\min}$  is zero (no women is

subject to violence). Again, this new dimension was introduced with the same weight as the rest. In PNUD (2007a), there were small differences between the HDI rank and that of the modified index. However, in PNUD (2009) the differences were bigger and pointed to four states that performed well in HDI, but not so good when the absence of violence against women was introduced (Distrito Federal, Jalisco, Aguascalientes and Sonora).

<b>Table 1. Differences in HDI rank with an insecurity index</b>							
<b>State</b>	<b>HDI rank</b>	<b>HDI rank with insecurity index</b>	<b>Diff. in rank</b>	<b>State</b>	<b>HDI rank</b>	<b>HDI rank with insecurity index</b>	<b>Diff. in rank</b>
Aguascalientes	5	7	-2	Morelos	16	26	-10
Baja California	7	32	-25	Nayarit	23	9	14
Baja California Sur	4	30	-26	Nuevo León	2	6	-4
Campeche	9	1	8	Oaxaca	31	25	6
Coahuila	3	3	0	Puebla	25	19	6
Colima	14	4	10	Querétaro	12	13	-1
Chiapas	32	24	8	Quintana Roo	6	29	-23
Chihuahua	8	22	-14	San Luis Potosí	20	27	-7
Distrito Federal	1	10	-9	Sinaloa	17	8	9
Durango	15	11	4	Sonora	10	2	8
Estado de México	18	23	-5	Tabasco	21	28	-7
Guanajuato	22	20	2	Tamaulipas	11	14	-3
Guerrero	30	21	9	Tlaxcala	24	5	19
Hidalgo	27	17	10	Veracruz	28	15	13
Jalisco	13	16	-3	Yucatán	19	31	-12
Michoacán	29	12	17	Zacatecas	26	18	8

Source: PNUD (2005)

At the end of the day, a trivial and a not so trivial lesson is learned from the exercise of adding new dimensions to the HDI. On one hand, it is clear that the HDI overlooks important dimensions of human development. On the other, the specific impact of a

particular dimension can be acknowledged when carrying out this sort of sensitivity analysis.

#### **2.4 An inequality sensitive HDI**

An extended HDI improves the basic index as an indicator of development by incorporating information beyond GDP, health and education. However, like its predecessor, it fails to account for the inequality with which the different benefits of development are distributed among individuals. Addressing this issue, the first National Report, following Foster, Lopez-Calva and Szekely (2003) proposed a new class of inequality sensitive human development index.

A problematic aspect of the HDI is its aggregation method that combines the data into an overall index: the procedure ignores the distribution of human development across people and dimensions. It simply does not distinguish whether the benefits of development are reaching all individuals, or whether they are concentrated among a few. It also does not matter if a given level of HDI is reached because extraordinary achievements in one dimension with poor results in the rest, or with some sort of balanced development. In countries with high inequality and unbalanced achievements like Mexico, this is an important issue as the HDI will not be highly representative.

Anand and Sen (1995) and Hicks (1997) had proposed useful distribution-sensitive measures of human development, but at the cost of consistency: in their analysis, it is possible for welfare to rise in one region and stay fixed in another, while overall welfare

falls. For this reason, the following basic properties for a general HDI are advanced as axioms:

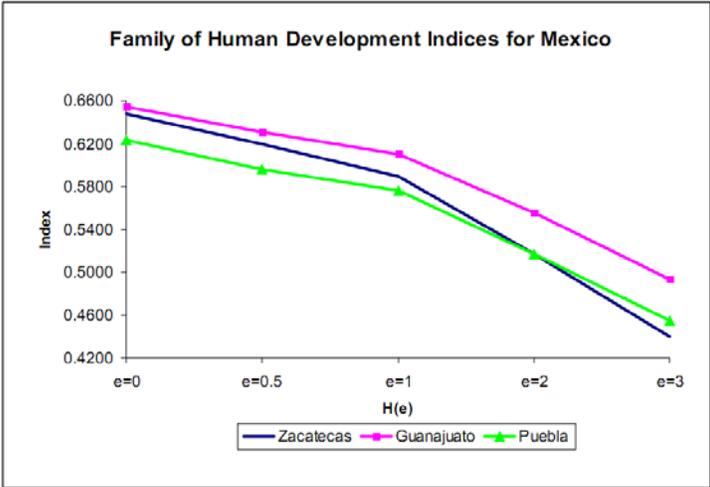
- 1) Symetry in dimension: each dimension is equally important in the estimation of the HDI
- 2) Symetry in population: each individual is equally important in the calculation of the HDI
- 3) Replication invariance: the HDI for a group adopts a per capita interpretation of development
- 4) Monotonicity: the HDI increases if at least one individual in one dimension improves and the rest stays the same
- 5) Homogeneity: if all dimensions of all individuals are cut in half, the HDI is cut in half
- 6) Normalization: if all entries have a certain value, say  $\frac{1}{2}$ , then the HDI adopts such value
- 7) Continuity: small changes in one dimension translate in small changes in the HDI
- 8) Subgroup consistency: a change in development within a subgroup of the population is associated with the corresponding change for the population as a whole
- 9) Transfer principle: ceteris paribus, if inequality reduces among two individuals in at least one dimension, the HDI rises.

The standard HDI finds the arithmetic means of the three dimensions of development (state, municipality, household or individual) and applies the arithmetic mean again, this time to the basic units, to obtain the overall index. The first departure from this approach in the new index (called Generalized Means HDI or  $H(\epsilon)$ ) is the use of a distribution-sensitive general mean to summarize the dimension-specific level of human development. A second step is the use of the generalized mean to summarize the information of all basic units.

A generalized mean involves an algorithm that reduces the value of the HDI as inequality ( $e$ ) increases, where  $e$  can be interpreted as an “inequality aversion” parameter. This means that if two groups have the same simple HDI, but one has a more unequal distribution (among individuals or dimensions) this will involve a lower  $H(e)$  as the inequality aversion parameter is bigger.

An illustration of this was presented in Foster, Lopez-Calva and Szekely (2003). Their procedure consisted on imputing to individuals a proxy of life expectancy at birth from their municipalities, estimating each individual income from the national GDP accounts with a cruder method than the imputation techniques described in section 2.2, and restricting the analysis to the population older than 14 years in the case of literacy, and between 6 to 24 years in the case of school enrollment.

**Graph 4**

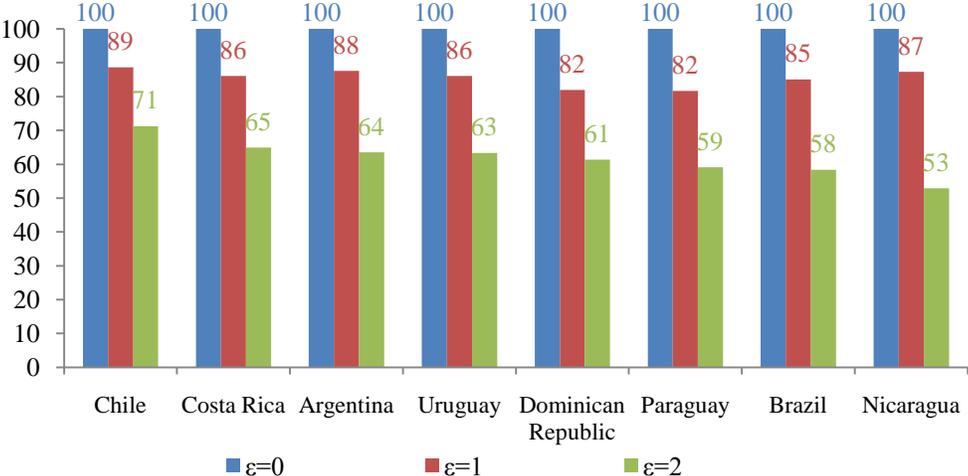


As can be seen in graph 4,  $H(e)$  decreases as  $e$  increases, which means that there is a loss in development due to inequality and this loss is bigger as inequality aversion rises. However,

he information also illustrates that the H(e) ranking could be reversed for different values of  $\epsilon$ , which means that different kinds of inequality can be translated in different values of H(e) as inequality becomes more important.

Other countries have adopted this procedure and found losses on human development due to inequality. Vigorito et al. (2009) replicated the inequality sensitive HDI methodology for seven Latin American countries (Nicaragua, Paraguay, Brazil, Dominican Republic, Uruguay, Argentina and Chile). Their results show that HDI reduces considerably after inequality adjustments are taken into account; when the HDI components are analyzed separately, it turned out that health and education components had increased their levels and reduced their inequalities during 1999 and 2006, meanwhile income component kept pushing overall HDI inequality.

**Graph 5 HDI losses due to inequality, IDH ( $\epsilon=0$ )=100**



Source: Vigorito et al. (2009)

### **3. HDI for households and individuals**

The Generalized Means HDI not only identifies the loss on human development associated to inequality, but also allows us to delve into important issues when group differences take center stage: If the HDI of one state increases and changes inequality levels, how much would aggregate HDI increase? How much would the HDI increase if there's an unbalanced growth of its dimensions? What is the total HDI gain when efforts are focused on improving the least advantaged group of individuals? How much can HDI increase if there is an increase in one individual's dimension?

These important questions can be addressed with the new index, but one basic issue remains: in order to apply this or any other technique to explore disaggregated human development data, how far can HDI disaggregation be extended? Akder (1994) points out that "The limit of disaggregation could be reached if one could calculate the HDI for each individual", but he does not come close to this objective.

There have been few recent efforts to disaggregate the HDI beyond geographical units in order to analyze the distribution of human development. Grimm et. al. (2008) proposed calculating the HDI by income quintiles using income and health surveys. The basic idea is to form groups, in this case income groups, for which the traditional HDI variables are identified: life expectancy at birth, adult literacy, enrollment of 6-23 years old population, and per capita household income adjusted to match GDP statistics. This was done for 2 developed and 13 developing countries. Their results showed a significant HDI inequality, particularly in Sub-Saharan Africa. Grim et. al. (2009) extended this study to 11 developed

countries and also found a significant level of inequality and a strong negative correlation between the level and the inequality of the HDI.

A very different approach is used in the *Well-O-Meter* of the American Human Development Project (2009). This interactive web page builds an individual human development level, equivalent of the HDI, by asking 25 questions (gender, age, location, family health background, health habits, labor income and schooling). This exercise clearly assigns points for each answer, but it remains a black box how each piece of information is weighted and how all the data is aggregated. However obscure, this is the right way to pursue for two reasons. Even if basic capabilities are strongly dependent on social conditions or if there are collective capabilities, as suggested by Stewart (2005), the basic unit for defining human freedom in a normative sense is the individual, because it is the basis of agency or autonomous choices. On the other hand, an individualistic take on freedom makes sense methodologically in order to explain aggregate outcomes, for example the HDI for a region, based on the constraints and choices of individual agents and their interactions. The moral relevance of a person and the importance of micro foundations justify an approach that starts the analysis of the HDI at the individual level, even if such analysis does not stop there.

One shortcoming of any approach that uses groups to identify the classic variables of the HDI is that certain individuals will never have a clear picture of their human development. Assume, for example a group of persons older than 24 years that have the benefits of modern medicine, above average education years, but currently do not go to school. Their

life expectancy at birth could have no relation with their current life expectancy (for their gender, age group and income); even if the HDI recognizes their literacy, is not clear what it is going to say for them not being in school, even if their age group typically is out of it.

In this section a proposal for addressing these and other issues when disaggregating the HDI at the household and individual level, inspired by the experience of the Well-O-Meter will be developed. This section will begin by summing up the basis of state and municipal disaggregation of the HDI.

### **3.1 From state and municipal disaggregation to an individual HDI**

Usually, official and administrative data for national and state level allow computing HDI according to UNDP methodology. However, this is not always the case for deeper levels of disaggregation, where methodological decisions have to be made. For instance, Census data, which is often the most reliable nationwide source of information at sub national level, allows sub national representativeness, but fails to capture income accurately. Besides, it's not always possible to process administrative data on life expectancy at birth at sub national level (i.e. municipality), so other proxies have to be used instead (for instance infant mortality rate). Table 2 shows some of these methodological decisions at different levels of aggregation in Mexico and the proposal for a household and individual HDI.

The following sections describe each of these methodological decisions and show how traditional HDI can be computed and, in some way, improved by the richness of data at this level of disaggregation. For this purpose, data from Mexican survey ENIGH is used (see

annex 1 for a general description). As usual, the performance in each of the 3 dimensions that make up HDI (life expectancy, education and income) will be obtained by the general formula (see formula 1).

**Table 2. HDI and its application at different levels of aggregation in Mexico**

<b>Dimension</b>	<b>Country and States</b>	<b>Municipality level</b>	<b>Household &amp; individual level</b>
<b>A long and healthy life</b>	Life expectancy at birth (years)	Infant mortality rate	Life expectancy per age and gender (years)
<b>Knowledge</b>	Combined gross enrolment rate	School attendance rate	School attendance rate
	Adult literacy rate	Adult literacy rate	Adult literacy rate
	-	-	Schooling for an specific age
<b>A decent standard of living</b>	GDP per capita	Imputed annual household income	Household annual income

Source: Human Development Research Office, UNDP Mexico.

### 3.2 Life expectancy index

Much like Grimm et. al (2008), life tables are used to compute life expectancy, but in this case the interest relies in life expectancy at a given age and not life expectancy at birth. As described in table 2, the life expectancy index at national and state level considers life expectancy at birth. In order to estimate it at household level, life tables for age and gender and other characteristics are needed. This information, along with rich information on socio demographic characteristics, which are usually contained in survey data, makes it possible to compute it for every household member. In order to allow international comparisons, similar data would be required to set life expectancy thresholds.

## Life tables

Table 3 shows information about potential sources of information about life tables in Mexico. Although some of them are available even at state level and are computed by government's entities, the most recent and complete estimations are CONAPO's, which is also the official body in charge of computing life expectancy and infant mortality rates.<sup>ii</sup>

**Table 3. Life tables for Mexico in national and international sources**

	<b>Source/Author</b>	<b>Level</b>	<b>Groups</b>	<b>Years</b>
<b>1</b>	Composterga, S.	National	By sex & age [0-95]	1980
<b>2</b>	Comisión Nacional de Seguros y Fianzas CNSF)	National	General & by age limited to [12-56]	2000
<b>3</b>	Mexico Health Metrics Report (SSA)	National, State	General, by sex & age [5 yearly groups]	2000
<b>4</b>	Consejo Nacional de Población (CONAPO)	National, State	General, by sex & age [0-100]	2000-2008
<b>5</b>	World Health Organization (WHO)	International, National	General, by sex & age [5 yearly groups]	1990, 2000, 2006

These tables are exogenous to income or any other economic variable, so life expectancy for individuals living in the same state, with the same age and gender is the same, even if they exhibit different income levels (i.e. income deciles or cope different levels of vulnerability). To overcome this common feature in life tables, life expectancy is adjusted by income through a two stage linear regression model<sup>iii</sup>.

The first stage removes state income effects in life expectancy through a linear regression model on life table's data at state level. The model specification is as follows:

$$2) \quad Ex_{a,g,s} = \alpha_0 + \alpha_1 \ln(\text{income}_s) + \alpha_2 \text{age} + \alpha_3 \text{age}^2 + \alpha_4 \text{gender} + \alpha_5 \text{state} + U_{a,g,s}$$

Where  $Ex_{a,g,s}$  is life expectancy by age (a), gender (g) and state (s) in life tables;  $income_s$  is the average state income<sup>iv</sup>; age is age in life tables; gender is a dummy variable for men and state is a dummy for each state. The second stage adds personal income effects in life expectancy considering the parameter  $\alpha_1$  estimated in the first stage.<sup>v</sup> This leads to an individual adjusted life expectancy as follows:

$$3) \quad (Ex_{a,g,s})^{Adj} = Ex_{a,g,s} - \alpha_1 \ln(income_s) + \alpha_1 \ln(income_i)$$

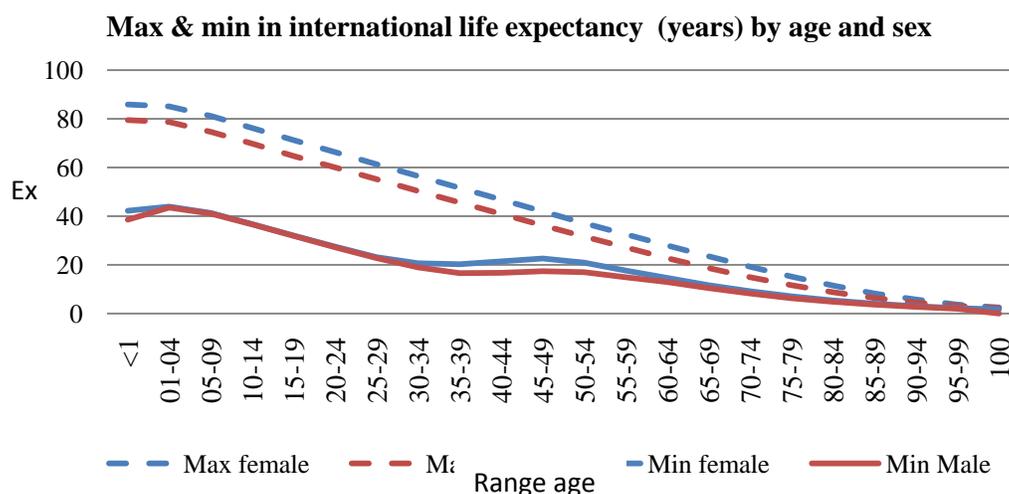
Where  $(Ex_{a,g,s})_i^{Adj}$  is the income-adjusted life expectancy for individual (i) considering his/her age, gender and state<sup>vi</sup>.

### International thresholds

In the original HDI setting, a maximum and a minimum life expectancy at birth were fixed as references, so similar thresholds should be fixed for each age and gender group. Since 1999, WHO began producing annual life tables for all its member countries. These life tables form the basis of all WHO's estimates about mortality patterns and levels world-wide.

Information for more than 190 countries with comparable life tables for 1990, 2000 and 2006 are available. In order to determine the reference for maximum and minimum, a program to determine which country gets the highest and the lowest life expectancy per age and gender was developed. Graph 5 shows the thresholds results and annex A shows the list of countries for each threshold.

**Graph 5**



In order to conciliate normative UNDP life expectancy at birth with WHO estimates, an adjustment factor was computed using the ratio between both sources by gender. Once this factor is obtained, it is applied to international thresholds described above in order to make these two sources compatible. Table 4 describes this information.

**Table 4. Max & min in life expectancy at birth (years) by gender<sup>vii</sup>**

Gender	WHO		UNDP		Adjustment	
	Max	Min	Max	Min	Max	Min
<b>Male</b>	79.5	36.6	82.5	27.5	1.04	0.75
<b>Female</b>	85.9	42.3	87.5	22.5	1.02	0.53

Estimating the life expectancy index

The income-adjusted life expectancy for age, gender and state is imputed to each individual in the survey sample, in order to compute life expectancy index at household level. Individual index is calculated as follows:

$$4) \quad LEI^i = \frac{Ex_{a,g,s}^i - Ex_{a,g}^{\min}}{Ex_{a,g}^{\max} - Ex_{a,g}^{\min}}$$

Where  $LEI^i$  is the life expectancy index for individual “i”;  $Ex_{a,g,s}^i$  is the income-adjusted life expectancy imputed to individual “i” with age “a”, gender “g” in state “s” (see formula 3); and  $Ex_{a,g}^{\min}$  and  $Ex_{a,g}^{\max}$  refer to the international minimum and maximum life expectancies for age “a” and gender “g”, respectively. Finally, the life expectancy index for household “h” is the average index of all household members.

$$5) \quad \text{Life Expectancy Index}^h = \sum_{i=1}^n (LEI^i / n)$$

Where n is the number of household members in household “h”<sup>viii</sup>.

### 3.3 Education index

Following the early specification of the HDI in the Global Human Development Report (UNDP, 1990), a key variable to identify knowledge capabilities, in addition to literacy, are years of schooling adjusted for each individual’s age. However, some special cases need further adjustments.

Table 2 also describes UNDP methodology for calculating the education index. Traditionally, this indicator considers two indices, one for adult literacy (people aged 15 or more) and another for combined gross enrolment (for people aged 6-24). These two indices

are combined to create the education index, with two-thirds weight given to adult literacy and one-third weight to combined gross enrolment.

The education index proposed at household level extends this panorama. To broaden this indicator for all household members, the age range is opened up and a schooling indicator is included. The new setting considers literacy for all household members aged 6 or more; school attendance is required only for members aged 6 and a normative schooling rate is considered for household members aged 7 or more.

The literacy indicator assumes all individuals aged 6 or more to be able to read and write after completing the initial year of basic education.<sup>ix</sup> This indicator is defined as follows:

$$\text{Literacy indicator}^i = \begin{cases} 1 & \text{if individual "i" is able to read and write and } \text{age}^i \geq 6 \\ 0 & \text{otherwise} \end{cases}$$

The school attendance indicator requires enrollment for people aged 6, which is the age at which children are supposed to be enrolled at school. This indicator is defined as follows:

$$\text{School attendance}^i = \begin{cases} 1 & \text{if individual "i" is enrolled and } \text{age}^i = 6 \\ 0 & \text{otherwise} \end{cases}$$

The schooling rate indicator calls for all individuals aged between 6 and 24 to achieve a goalpost in terms of years of schooling relative to individual's age.<sup>x</sup> This indicator is defined as follows:

$$\text{Schooling rate}^i = \begin{cases} \frac{\text{Schooling}^i}{\text{Age}^i - 6} & \text{If age}^i \in [7, 24] \\ \frac{\text{Schooling}^i}{18} & \text{If age}^i > 24] \\ 0 & \text{otherwise} \end{cases}$$

Once these indicators are obtained, the education index is calculated as follows:

$$\text{EI}^i = \begin{cases} (2/3) \text{ Literacy indicator}^i + (1/3) \text{ schooling rate}^i & \text{if age}^i \geq 6 \\ (2/3) \text{ Literacy indicator}^i + (1/3) \text{ school attendance}^i & \text{if age}^i = 6 \\ 1 & \text{if education index}^i > 1 \end{cases}$$

Finally,  $\text{EI}^i$  is the education index of household member “i”. The education index for household “h” is the average of all household members’ indices.

$$6) \quad \text{Education Index}^h = \sum_{i=1}^n (\text{EI}^i / n)$$

Where n is the number of household members aged 6 or more in household “h”. In the case of household members aged 5 or less, the average index of the rest of the household is imputed as their education index, under the assumption that the opportunities to acquire knowledge appropriate for their age is in direct proportion to the education index of the rest of the household members.

### **3.4 Available resources index**

As described in table 2, GDP index is traditionally calculated using Gross Domestic Product at purchasing power parity (GDP PPP \$US). At household level, the proposal is to obtain this index through the per capita household total current income. For the Mexican case this concept of income is the one defined by the Technical Committee for Poverty Measurement (TCPM). The TCPM was an autonomous entity created by the federal government to define an official poverty measurement. This committee was mainly composed by scholars and defined a concept of income at household level with ENIGH for these purposes (Székely, 2005). Of course, for a more general measure, the concept of income could be changed, but in the context of Mexico it's particularly useful to use the TCPM definitions to allow comparisons with other welfare measures.

Total current income considers monetary and non-monetary resources. Monetary income considers receipts from employment, own business, lending of assets and public and private transfers. Non monetary income considers received gifts and the value of services provided from within the household, such as rental value of owner occupied dwelling or self consumption. ENIGH captures up to 6 monthly receipts of income. Following TCPM procedures, each of these receipts is expressed in terms of a month of reference<sup>xi</sup>. After this, a long-run household income is obtained as the average of these records. This income is divided by the number of household members in household "h" to get per capita income, which is used as individual source of resources.

Income is adjusted to be compatible with official UNDP income goalpost. First it is adjusted to national accounts using a factor computed with the ratio between the available household income reported in the national accounts and the current income obtained with ENIGH. Second, it is expressed in annual terms<sup>xii</sup>. This is the information to be expressed in PPP US\$ with World Bank information. The available resources index at household or individual level is then obtained by the general formula as follows:

$$7) \quad GDP\ Index^h = \frac{\ln(y^h) - \ln(y_{\min})}{\ln(y_{\max}) - \ln(y_{\min})}$$

Where  $GDP^h$  is the Gross Domestic Product index for household or individual h;  $y^h$  is the annualized-adjusted household per capita income (or individual income);  $y_{\min}$  and  $y_{\max}$  are the official UNDP goalpost values<sup>xiii</sup>.

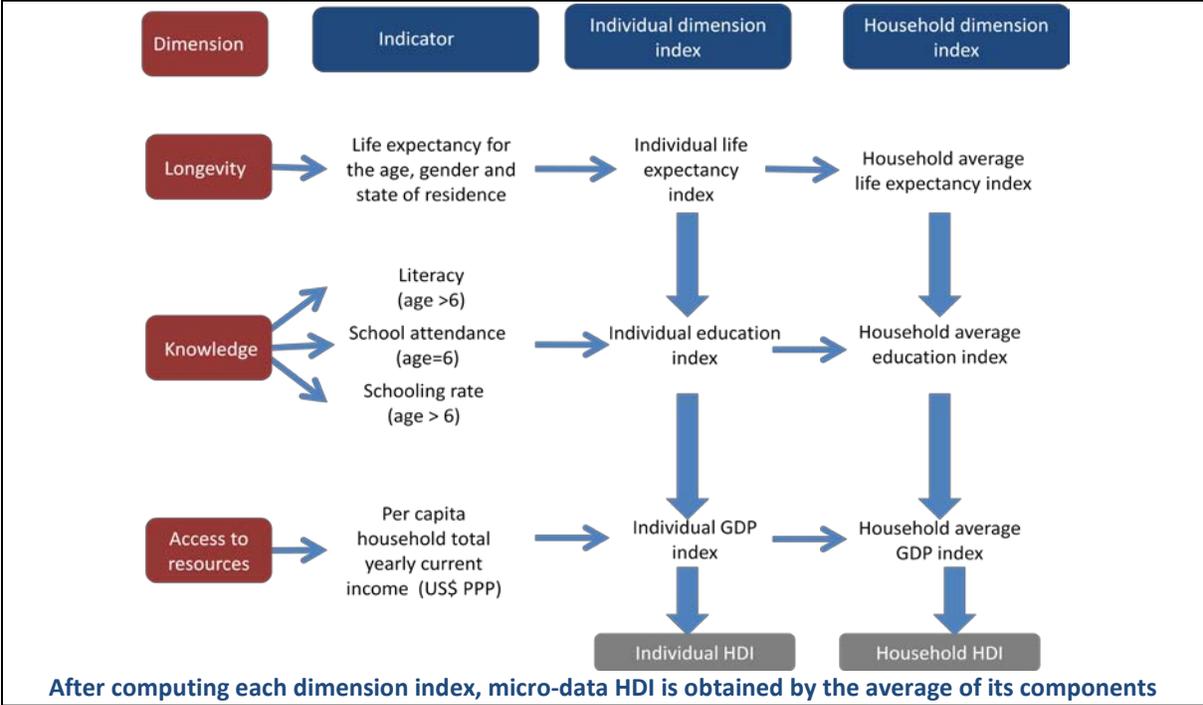
### 3.5 HDI index

As in the standard case, once the dimension indices have been calculated at household or individual levels, determining the HDI is straightforward. It is a simple average of the three dimension indices.

$$8) \quad HDI^h = \frac{1}{3}(\text{Life expectancy index}^h) + \frac{1}{3}(\text{Education index}^h) + \frac{1}{3}(\text{GDP index}^h)$$

This construction (see diagram 1 for a synthesis) could be adapted, and eventually further refined, by taking advantage of the availability and, in many cases, comparability of household survey data in most countries. The focus adopted here shows a move in a more disaggregated direction away from territorial or grouped attention.

**Diagram 1 Individual and household HDI construction**



Micro-data HDI has been calculated for several years at the household level, identifying men and women that belong to households with different human development indicators, and for 2006 and 2008 at the individual level (See Table 5 and Graph 5).

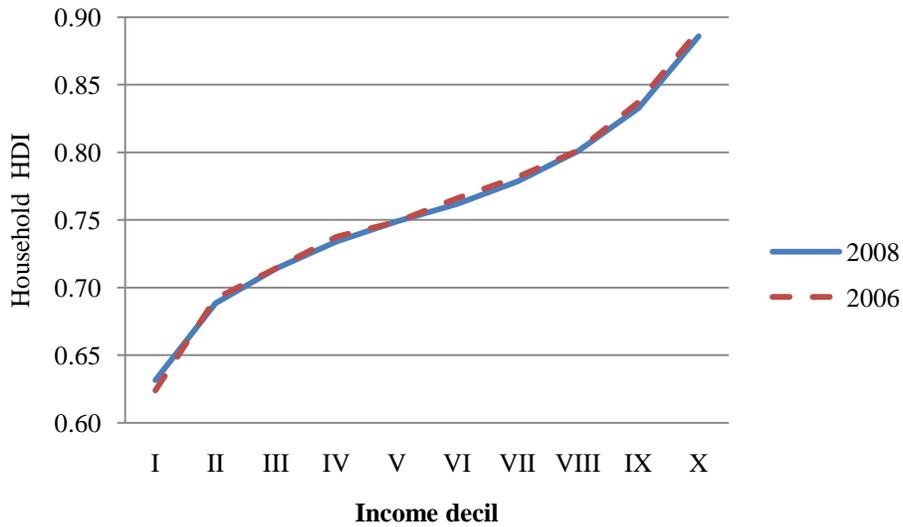
**Table 5**  
**Individual HDI by income decil, 2008**

	<b>General</b>	<b>Men</b>	<b>Women</b>
<b>I</b>	0.6200	0.6223	0.6180
<b>II</b>	0.6854	0.6898	0.6813
<b>III</b>	0.7130	0.7194	0.7072
<b>IV</b>	0.7330	0.7388	0.7274
<b>V</b>	0.7501	0.7535	0.7471
<b>VI</b>	0.7609	0.7684	0.7539
<b>VII</b>	0.7794	0.7883	0.7712
<b>VIII</b>	0.7987	0.8050	0.7925
<b>IX</b>	0.8258	0.8331	0.8189
<b>X</b>	0.8820	0.8901	0.8745

Table 5 shows that for each decile, women belong to households with lower HDI. This is not the same as to say that women have a lower HDI for each income level, since in this case the HDI of a given household is imputed to each individual. However, the calculation of the HDI at the individual level could give the exact picture. It is also interesting to notice that the HDI gives a new perspective to recent changes in Mexico's welfare indicators.

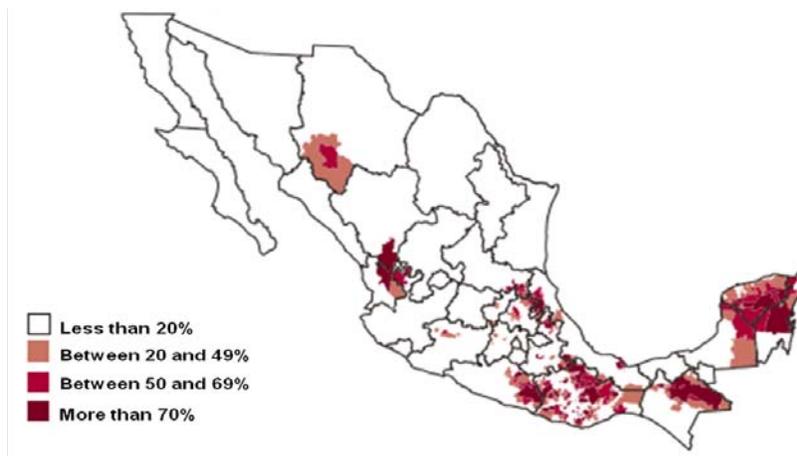
From 2006 to 2008, income levels decreased for all, but the richest decile in Mexico. Income poverty increased, based on the TCPM definition of income, and there was a widespread sense that welfare levels not only stagnated but receded. However, when measuring the HDI at the individual level some income groups improved in HDI terms and none worsen, so welfare levels as measured by the HDI persisted.

**Graph 6 Household HDI by income decil , 2006-2008**

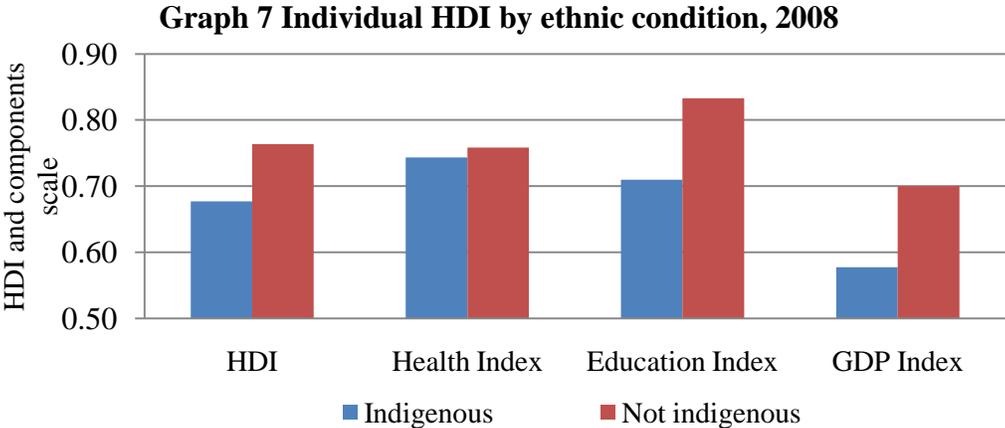


Individual HDI can also provide detailed evidence for other population groups, like those spread in large geographical regions as is the case of Mexico's indigenous people (see map 1). Due to lack of information, HDI for this population should have been computed by imputing regional or grouped information to individual data as if this were the case of a homogeneous group.

**Map 1 Indigenous people at municipality level in México**



Individual HDI makes possible to operate the other way around; first performing individual estimates and then grouping either by regional or language characteristics. According to graph 7, large gaps have been detected when comparing the performance of this group, being particularly relevant those associated to available resources index. Similar approximations of individual HDI would also be useful to make estimations for rural and urban areas or according to a life cycle setting.



**Final Remarks**

This paper surveyed the main informational, conceptual and measurement theory adjustments made to the HDI in the Mexican National Human Development Reports and some of their uses. It also presented a way in which the calculation of the HDI could be carried out to the individual and household level.

Informational changes to the HDI include: 1) redistributing GDP from oil producing states that went to the Federal Government, and then allocated to the rest of the territory, so a better picture of available resources is obtained for a given region, and 2) imputing average

household per capita income from income surveys to census municipality data in order to obtain key missing data to analyze regional inequality. State level information made it possible to set counterfactuals to analyze the first effects of internal migration on development, while municipal data allowed applying inequality decomposition techniques to identify the main sources and regions contributing to HDI overall inequality.

Conceptual adjustments were presented as a kind of sensitivity analysis when introducing an additional dimension, and its correspondent index, to the basic HDI framework. In this case, being free from local crime and the absence of violence against women were the new dimensions of human development. In the first case, there were significant changes in the development ranking of Mexican states. In the second, the differences in ranking were not so big, but point out to problematic regions, which is a useful result for advocacy and policy targeting.

A key contribution to the HDI literature from the Mexican National Reports is the proposal of an inequality sensitive development index based on the concept of generalized means. The Generalized Means HDI is grounded in an axiomatic approach that guaranties logical consistency, allows to make explicit value judgments on the importance of inequality (through the inequality aversion parameter), and unambiguously answers important questions about the evolution of the HDI when inequality in dimensions or groups is involved.

Finally, a way to disaggregate the HDI at the household and individual level from income surveys data is proposed. This involves the use of life expectancy for each individual according to their age, gender, location and income group; education attainment is measured by adding expected school years for a given age to literacy and enrollment indicators, and available resources is measured by disposable income. Appropriate thresholds are defined for each variable, and when no sensible estimation is possible for a family member, the average of the rest of the household is imputed.

The Mexican experience is not so different from other cases when confronting missing data or gross biases in some variables (see Bedi, 2007); in other countries the addition of new dimensions and variables to the HDI is also usual (see PNUD 2008b). In contrast, migration analysis using HDI counterfactuals and the decomposition of inequality indices for a disaggregated HDI are not so common, but perhaps a completely original contribution of the Mexican experience is the proposal of a rigorous inequality sensitive HDI.

We hope that an additional tool for the advancement of sub-national analysis of human development could be the household and individual calculation of the HDI proposed here.

## References and data sources

### References

Akder, A. Halis (1994): “A Means to Closing Gaps: Disaggregated Human Development Index”, Human Development Report Office Occasional Paper 18. New York: United Nations Development Program.

Alderman, H., M. Babita, G. Demombynes, N. Makhatha, and B. Özler

(2002): “How Low Can You Go?: Combining Census and Survey Data for Mapping Poverty in South Africa,”, Journal of African Economics.

American Human Development Project (2009), <http://www.measureofamerica.org/well-o-meter/>

Anand, Sudhir and Amartya Sen (1995): “Gender Inequality in Human Development: Theories and Measurement”, Human Development Report Office Occasional Paper 19. New York: United Nations Development Programme.

Bedi, Tara, Aline Coudouel and Kenneth Simler (2007), *More Than A Pretty Picture: Using Poverty Maps to Design Better Policies and Interventions*, Washington D.C.: The World Bank

EIA. (2009). U.S Energy Information Administration. International. Country Analysis Briefs: Saudi Arabia.

[http://www.eia.doe.gov/emeu/cabs/Saudi\\_Arabia/Background.html](http://www.eia.doe.gov/emeu/cabs/Saudi_Arabia/Background.html).

Elbers, Chris; Lanjouw, Jean & Lanjouw, Peter (2002). “Micro-level estimation of welfare”, Policy Research Working Paper Series 2911. Washington, DC: World Bank

Elbers, C., J. O. Lanjouw, P. Lanjouw, and P. G. Leite (2001): “Poverty and

Inequality in Brazil: New Estimates from Combined PPV-PNAD Data,”, The World Bank.

Elbers, C., P. Lanjouw, J. Mistiaen, B. Özler, and K. Simler (2002) : “Are

Neighbors Equal? Estimating Local Inequality in Three Developing Countries,”, The World Bank.

Esquivel, Gerardo, et. al. (2003) “Desarrollo Humano y crecimiento económico en México, 1950-2000”, Estudios sobre Desarrollo Humano, PNUD México, No. 2003-3

Estudios sobre Desarrollo Humano, PNUD México, No. 2003-4.

Foster, James E., Luis F. López-Calva y Miguel Székely (2003) Measuring the Distribution of Human Development: Methodology and an Application to Mexico.

Grimm M., K. Harttgen, S. Klasen and M. Misselhorn (2008) 'A Human Development Index by Income Groups' World Development, 36 (12), 2527-2546.

Grimm M., K. Harttgen, S. Klasen, M. Misselhorn, T. Munzi, T. Smeeding (2009) 'Inequality in Human Development: An Empirical Assessment of 32 Countries' Luxembourg Income Study Working Paper Series, Working paper No. 519.

Hicks, D. A. (1997), "The Inequality-Adjusted Human Development Index: A Constructive Proposal", World Development, 25, pp. 1283-1298.

Leyva-Parra. Gerardo (2005). "El ajuste del ingreso de la ENIGH con la contabilidad nacional y la medición de la pobreza en México "Miguel Székely (coord.) (2005). "Medición de la pobreza: variantes metodológicas y estimación preliminar", in "Números que mueven al mundo: la medición de la pobreza en México", Miguel Ángel Porrúa, Mexico, 2005.

López Calva, L.F; Meléndez, A; Rascón, E; Rodríguez, L. y Székely, M. (2005). "Poniendo al ingreso de los hogares en el mapa de México. El Trimestre Económico

Lustig, Nora. (2007). "Salud y Desarrollo Económico. El caso de México. El Trimestre Económico. México, octubre-Diciembre. Vol. LXXIV (4). Num 276. Mexico

PNUD. (2003). Informe sobre Desarrollo Humano México 2002. México: Ediciones Mundi-Prensa.

PNUD. (2005). Informe sobre Desarrollo Humano México 2004. México: Ediciones Mundi-Prensa.

PNUD. (2007a). Desarrollo Humano y Violencia contra las mujeres en Zacatecas. México: Ediciones Mundi-Prensa.

PNUD. (2007b). Informe sobre Desarrollo Humano México 2006- 2007. México: Ediciones Mundi-Prensa.

PNUD. (2008a). Índice de desarrollo humano municipal en México 2000-2005. México: Ediciones Mundi-Prensa.

PNUD (2008b) Informe Nacional de desarrollo humano Panamá 2004. San José: NeoGeográfica, S.A.

PNUD. (2009). Indicadores de Desarrollo Humano y Género en México 2000-2005. México: Ediciones Mundi-Prensa.

Soloaga, Isidro y Lara, Gabriel. (2006). "Evaluación del impacto de la migración sobre el cálculo del índice de desarrollo humano en México". Documento de apoyo del Informe sobre Desarrollo Humano México 2006-2007. México: PNUD.

Stewart, Frances (2005) "Groups and capabilities", Journal of Human Development and Capabilities, Volume 6, Issue 2 July 2005 , pages 185 - 204

Székely, Miguel (coord.). (2005). "Medición de la pobreza: variantes metodológicas y estimación preliminar", en "Números que mueven al mundo: la medición de la pobreza en México", Miguel Ángel Porrúa, México, 2005.

UNCTAD. (2009). The least developed countries Report 2009:the state and the governance. United Nations publication, Sales No. E.09.II.D.9. new York and Geneva

UNDP. (1998), Human Development Report. UNDP, New York.

Vigorito, et.al. (2009). <http://www.oecd.org/dataoecd/55/18/44101097.pdf>

World Bank. (2008). World Development Indicators. The International Bank for Reconstruction and Development/World Bank, USA. Vol 8. First printing April 2008.

Zepeda Lecuona, Guillermo. (2004). Crimen sin castigo. Procuración de Justicia Penal y Ministerio Público en México. México: Centro de Investigación para el Desarrollo, A. C.-Fondo de Cultura Económica.

#### Data sources

CONAPO. 2008. Consejo Nacional de Población. 2008. Data base. Mimeo. México

INEGI. Encuesta Nacional de ingresos y Gastos de los Hogares.

<http://www.inegi.org.mx/inegi/default.aspx?s=est&c=16787&e=&i=>

UNESCO. 2008.

[http://www.uis.unesco.org/statsen/statistics/yearbook/tables/Table3\\_1.html](http://www.uis.unesco.org/statsen/statistics/yearbook/tables/Table3_1.html)

World Bank. 2007. World Development Indicators 2007. Washington, DC: The World Bank. It can be consulted at: <http://biblioteca.udesa.edu.ar/guias/guiwdi.htm>

World Health Organization. 2008. Life tables.

[http://www.who.int/whosis/database/life\\_tables/life\\_tables.cfm](http://www.who.int/whosis/database/life_tables/life_tables.cfm)+

## **Annex A. Survey Data used for computing HDI**

Data for estimating household HDI comes from *Encuesta Nacional de Ingreso y Gasto de los Hogares* (ENIGH).<sup>xiv</sup> This survey outstands because of its availability, representativeness and comparability among time. ENIGH was first carried out in 1984 by INEGI<sup>xv</sup> but this has been done every two years since 1992<sup>xvi</sup>. It allows comparability because it is carried out in the same season and its sample design has not changed in a fundamental way. Its sample design is probabilistic, stratified, multistage and clustered which allows generalizing its results to all population.

ENIGH has traditionally been representative at the national level, and for the rural and urban populations. Besides household's income and expenditure, it collects a large array of household characteristics and household members' characteristics. Recent improvements in the survey now allow to obtain a wide range of information for instance about indigenous people or about the extension of public programs. The most recent version of it is now representative at regional and state level in most of the data there contained.

**Annex B. Countries in Max & Min in life expectancy per age and gender**

**International maximum & minimum in life expectancy per age and gender**

Age	Maximum		Minimum	
	Female	Male	Female	Male
<1	Japan	Iceland	Sierra Leona	Sierra Leona
01-04	Japan	Iceland, Australia	Zimbabwe	Lesotho
05-09	Japan	Iceland	Zimbabwe	Lesotho
10-14	Japan	Australia	Zimbabwe	Lesotho
15-19	Japan	Australia	Zimbabwe	Lesotho
20-24	Japan	Australia	Zimbabwe	Lesotho
25-29	Japan	Australia	Zimbabwe	Lesotho
30-34	Japan	Australia	Zimbabwe	Lesotho
35-39	Japan	Australia	Zimbabwe	Lesotho
40-44	Japan	Australia	Zimbabwe	Lesotho
45-49	Japan	Australia	Zimbabwe	Lesotho
50-54	Japan	Australia	Sierra Leona	Zambia
55-59	Japan	Australia	Sierra Leona	Zambia
60-64	Japan	Australia	Angola, Sierra Leona	Zambia, Sierra Leona
65-69	Japan	Japan, Australia	Sierra Leona	Sierra Leona, Angola
70-74	Japan	Australia	Angola, Sierra Leona	Angola, Sierra Leona
75-79	Japan	Japan	Sierra Leona, Angola	Sierra Leona, Angola
80-84	Japan	Japan	Angola, Sierra Leona	Angola, Sierra Leona
85-89	Japan	Japan	Sierra Leona, Angola, Guinea-Bissau, (Congo, Democratic Republic)	Sierra Leona, Angola
90-94	Japan	Japan	Sierra Leona, Guinea- Bissau, Angola, (Congo, Democratic Republic)	Angola, Guinea- Bissau, Sierra Leona
95-99	Japan	Japan	Sierra Leona, Angola, (Congo, Democratic Republic)	Sierra Leona, Guinea-Bissau, Swaziland
100	Japan	Japan, Australia	Lesotho, (Congo, Democratic Republic), Mozambique, Sierra Leona, Zambia, Guinea-Bissau, Swaziland, Center African Republic, Rwanda, Angola	Guinea-Bissau, Sierra Leona, Swaziland

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<sup>i</sup> For instance, oil generates about one-third of Venezuela's total GDP while this percentage is above 40 percent for Saudi Arabia, the world's largest producer and exporter of total petroleum liquids (EIA, 2009). But not only special cases like these would have to be considered, according to UNCTAD (2009) many countries (listed in that publication) have recently gone through years of record growth performance driven primarily by commodity sectors and propelled by the boom in international prices.

<sup>ii</sup> This life table, however, was computed by CONAPO for UNDP Mexico.

<sup>iii</sup> See Lustig (2007) for the link between economic resources and health.

<sup>iv</sup> This income was obtained through the average state income considering income at municipality level. This income estimate was imputed to CENSUS from ENIGH using the income concept described in GDP index. See UNDP (2008).

<sup>v</sup> The estimated value of  $\alpha_1$  is 0.7546154

<sup>vi</sup> See section GDP index for the concept of income used.

<sup>vii</sup> See UNDP (2002)

<sup>viii</sup>  $LEI^i$  is set 1 if  $LEI^i > 1$

<sup>ix</sup> Children in Mexico must be enrolled at school at age 3 to begin the process of reading and writing so that after 3 years they access to primary education at age 6.

<sup>x</sup> This maximum level of schooling assumes students to achieve one additional year of formal education after completing a BA degree. This will allow considering at least one year of postgraduate studies. This threshold is compatible with UNESCO (2008) standards.

<sup>xi</sup> In this case august.

<sup>xii</sup> For a deeper explanation on national account adjustment factors see Leyva-Parra (2005)

<sup>xiii</sup> If  $y^h \leq 0$  then  $\ln(y^h)$  is set 0. Also GDPI is set 1 if  $GDP > 1$

<sup>xiv</sup> Mexican household survey of income and expenditure

<sup>xv</sup> National statistics institute.

<sup>xvi</sup> An exception was 2005 when ENIGH also carried out the *Conteo de Población y Vivienda*.